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INTERIM REPORT ON REFINEMENTS AND OPERATOR TRAINING FOR THE SEISMIC COMMUNICATION AND CONTROL PROCESSOR SYSTEM (CCP)

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INTERIM REPORT ON REFINEMENTS AND OPERATOR TRAINING FOR THE SEISMIC COMMUNICATION AND CONTROL PROCESSOR SYSTEM (CCP)

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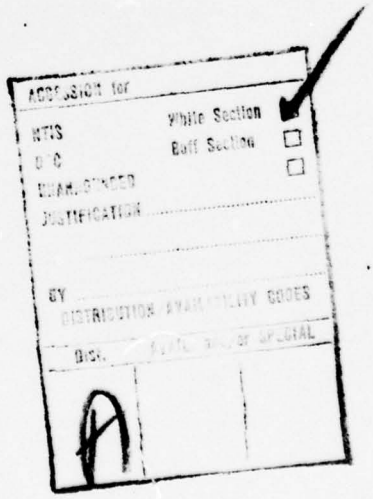

LIST OF ILLUSTRATIONS

LIST OF ACRONYMS

CCP	Communication & Control Processor
BBN	Bolt Beranek and Newman Inc.
SDAC	Seismic Data Analysis Center
CCA	Computer Corporation of America
ARPA	Advanced Research Projects Agency
IMP	Interface Message Processor
ALPA	Alaskan Long Period Array
LASA	Large Aperture Seismic Array
NORSAR	Norwegian Seismic Array
SIP	Seismic Input Processor
HIT	System Test Program
DDT	Dynamic Debugging System
PID	Psuedo Interrupt Device
SLI	Synchronous Line Interface
TIP	Terminal Interface Message Processor
FTP	File Transfer Protocol

Summary

This is an interim report reviewing the implementation and acceptance testing of several refinements to the Communications and Control Processor (CCP) and a series of training programs on the CCP operation and software.

The CCP was placed in operation in February, 1976, and during this contract period, BBN was asked to provide assistance to the operations contractor in the form of three training courses, maintenance assistance, and implementation of a series of software refinements to improve the system operation.

The courses were completed by the end of April of 1976, and the software refinements were completed and accepted in July, 1976.

Introduction

As part of the effort under the VELA program for improving the capability to detect and identify underground nuclear explosions by seismic means, ARPA is supporting the development of a worldwide network of seismic stations. Some of these stations will communicate on-line with the processing center at the Seismic Data Analysis Center (SDAC) and with a large archival storage system at Computer Corporation of America (CCA). The system design makes use of leased lines and the ARPA network for communications in this seismic network. The CCP is the central node in this network; i.e., it accepts data from the seismic stations, reformats the data, and forwards it to the storage and processing facilities.

The CCP was accepted and placed in operation in February, 1976, as a part of the SDAC. During the period from February to July of 1976, BBN has been providing assistance to the operations contractor in order to smooth the transition to operational status. This assistance has included 1) conducting three training programs in CCP operation and software, 2) assisting in diagnosing network problems, particularly in the use of the ARPA network, and 3) implementing several refinements in the CCP software to improve operations and to make restarting from a system failure faster and more convenient.

This report documents the required effort, with particular attention to the acceptance tests for the software refinements.

Training Programs

Three training programs involving hands-on experience with the CCP were conducted during this contract period.

The first training program covered the CCP system operation and the procedures available to the operator for diagnosing CCP and network problems. This course started in the middle of February, 1976, and continued for 25 working days. The outline for this course is shown in Figure 1. The usual procedure during each day of the program started with a short classroom presentation on the subject for the day. The course then moved to the CCP for hands-on demonstrations and practice under the supervision of the instructor.

The second training program reviewed in detail the procedures followed in the acceptance testing of the CCP. The objective was to insure that the operation contractor personnel could repeat any part of the original tests including examining and interpreting the contents of memory and machine registers. The acceptance tests could then serve as a performance baseline. This program started at the end of March and consisted of an 80-hour program that ran concurrently with the third training course, but usually on different days. The approximate schedule for the second and third training programs is shown in Figure 2. The program was organized into 3 to 5-hour sessions. The course outline by session is shown in Figure 3.

The third training program was intended to familiarize the operation contractor personnel with the CCP software system. It combined an elementary PLURIBUS programming course with a review of the CCP software system. The formal course sessions ran for a total of 40 hours, but the course included assigned

WEEK ONE

Normal Operation of the CCP

Day 1 Physical configuration of the machine
Day 2 Evaluating the overall CCP status
Day 3 Identifying CCP problems
Day 4 Restarting the CCP
Day 5 Problem session and review

WEEK TWO

Understanding the CCP Program

Day 1 Understanding channel identifiers
Day 2 Using the display DISPLAY
Day 3 System status and data site status
Day 4 Controlling the ALPA beamforming process
Day 5 Problem session and review

WEEK THREE

The CCP as a Host on the ARPANET

Day 1 Overview of the ARPANET (HOST and IMPS)
Day 2 The VELANET use of the ARPANET
Day 3 Diagnosing ARPANET difficulties
Day 4 Working with the Network Control Center
Day 5 Problem session and review

WEEK FOUR

CCP Interaction with Remote Sites

Day 1 ALPA and LASA
Day 2 NORSAR (TELL,REQUEST)
Day 3 SIP and 40A (SAVE,BACKUP,TELL)
Day 4 VELA (SEND)
Day 5 Problem session and review

WEEK FIVE

Operating the CCP System

Day 1 Maintaining the paper tapes
Day 2 Fault diagnosis in the VELANET
Day 3 Fault diagnosis inside the CCP
Day 4 Hardware troubleshooting and the HALF command
Day 5 Problem session and review

FIGURE 1: OPERATOR TRAINING PROGRAM OUTLINE

Date	Test Procedures	Programming
3/29/76	1-4	10-12
3/30/76	1-4	10-12
3/31/76	1-4	
4/1/76	1-4	
4/6/76	10-12, 1-5	
4/7/76	10-12, 1-5	
4/8/76		10-12, 1:30-4
4/9/76		10-12, 1:30-4
4/12/76	10-12, 1-5	
4/13/76	10-12, 1-5	
4/14/76	10-12, 1-5	
4/15/76	10-12, 1-5	
4/18/76		10-12, 1:30-4
4/19/76		10-12, 1:30-4
4/20/76		10-12, 1:30-4
4/21/76		10-12, 1:30-4
4/22/76		10-12, 1:30-4
4/26/76	10-12, 1-5	
4/27/76	10-12, 1-5	
4/28/76		10-12, 1:30-4
4/29/76		10-12, 1:30-4

FIGURE 2: CCP TRAINING SCHEDULE

Week 1: Test phase I

1. HIT approach and demonstration
2. Perform test 1B -- find a bad card
3. Questions and discussion on HIT
4. Tests 1A and 1C
5. CCP operator interaction command tests (Tests 2A and 2H)

Week 2: Site data handling tests

1. VELA network test configurations and data collection techniques
2. }
3. } Site data tests (2B, 2D, 2E, 2F, 2G)
4. }
5. ALPA beam test 2C

Week 3: Output and system tests

1. a) review system configuration
   b) Output protocols
2. Status test 2J
3. System data tests 2I and 2L
4. Output protocol tests 2K and 2M
5. Review and discussion

Week 4: Acceptance test phases 3 to 5

1. Reliability approach
2. Component failure tests 3A, 3B, 3C, and 3D
3. HALF concept and demonstration
4. HALF test 3E
5. TENEX assembler test phase 5

FIGURE 3: OUTLINE FOR CCP ACCEPTANCE TEST TRAINING

coding problems to be done at other times. The course was organized into sixteen 2-1/2 hour sessions. The course outline is shown in Figure 4. Program problems assigned during the course were debugged and run on the CCP.

First Week

1. PLURIBUS Structure, Maps, and Conventions
2. DDT - Dynamic Debugging Subsystem
3. Queues, Messages, and Common Subroutines
4. Strips, Ribbons, and Programming for the PID

Second Week

5. SLI Polling Module
6. Host Module - Network Control Program
7. General Input Module Structure
8. Structure of Specific Input Modules

Third Week

9. Display Module
10. Operator Modules
11. ALPA Beam Processing Module
12. Transmission to VELA Links

Fourth Week

13. Event Detector and SIP Output Modules
14. Norsar Output Module
15. Status Moudle
16. Reliability Module

Daily Schedule:

Each day the course will meet for two-and-a-half hours. The course will consist of lecture, discussion and hands-on changes to the CCP system.

FIGURE 4: OUTLINE FOR CCP PROGRAMMING COURSE

System Maintenance and Diagnostic Assistance

The major problem area requiring BBN assistance during this period was in the interaction of the various seismic network nodes using the ARPA network. The effort to debug the seismic network host-to-host and load problems was aggravated by residual problems in the PLURIBUS IMP installed at SDAC. By the end of this contract period most of the trouble, except for the dropouts in the NORSAR path, were at least understood, if not solved.

Some recommendations for future changes that came out of, or were confirmed by, this effort are:

1) The CCP network control program should be redesigned to protect the seismic traffic from blocking due to delays on any one path out of the CCP.

2) The CCP should have more buffer memory.

3) The IMP at CCA should be changed to a PLURIBUS IMP so that more reassembly buffer space can be provided.

4) Multiple message acknowledgement should be allowed when host level error control is used on a high data rate path.

Refinement Acceptance Tests

The acceptance tests on the CCP refinements were conducted June 30 and July 1, 1976. The tests followed the revision to the acceptance test procedures for the Communication and Control Processor included as Appendix I. The acceptance test results consist of CCP terminal outputs, hard copy plots from the CCP display, and the output from the TIP terminal used to control the TENEX system while loading the CCP over the ARPA network.

The following are notes and observations on the tests:

Test 2.N - Paper Tape Parameter Input

Preliminary instructions on preparation of the input tapes were not complete in explaining the need for throw away characters after the Control-D character and an ON command when several commands are punched on one tape. As a result, the government prepared command tape caused format error messages and required manual allignment in the reader. A listing of the command tape and the output of the interactive terminal are included under this section in the test results. The output terminal data for all tests is bound at the end of the test data volume.

Test 2.0.1 - Added Ground Motion Gain Factors

Gain factors used in the test were experimentally adjusted to give convenient displays. Due to the burned tube face, the output plots in the test data are difficult to read. A memory dump and hand calculations to test the gain factors are included in the test data.

In addition to test data, a list of default values assembled into the CCP program for NORSAR and LASA at the time of the tests is also included in the test data volume.

Test 2.0.2 - Vertical Display Scales

Data from this test include the interactive terminal output and a hard copy from the CCP display. Due to the poor condition of the display tube face, test on the hard copy from the display is almost unreadable.

Test 2.0.3 - Complete All Traces on Display

A mix of short and long period traces was displayed. The hard copy from the display shows that all traces were complete, but the text on the copy is illegible due to the burned tube face.

Test 2.P - Load the CCP Over the ARPA Network

The output from the terminal connected to the ARPA Network TIP shows the contents of the file directory at ISI and the interaction required to run raw FTP and load the CCP programs over the network.

Following the loading process, the system was run for 25 hours to complete the acceptance test. The CCP output typewriter printout during the above tests and for several hours of the 25-hour run is included in this section of the test data volume. Output from the rest of the 25-hour run is in the SDAC operating log books.

Conclusion

The acceptance test sequence ending on July 1, 1976 demonstrated that the refinements to the CCP software met specifications, and the revised programs were accepted by the Air Force.

The network maintenance and trouble analysis performed during this period have led to recommendations for several system changes. Some minor changes have been implemented. Additional recommendations are listed in the section of this report that deals with the system maintenance effort.

APPENDIX I
Acceptance Test Procedures for the CCP Refinements

(a modification to BBN Report 3185)

Section 2.N - Testing the Paper Tape Input of Parameters

This capability provides for the automatic input of any system parameter by means of a predefined paper tape. The format of the paper tape is identical to what would be entered manually on either of the operator TTY's, but the command is terminated by Control-D and a throw away character. That is, the paper tape contains a string of ASCII characters representing the desired command or sequence of commands, with each command followed by Control-D and an extra character such as a "rubout". Once the paper tape is placed in the paper tape reader and the reader is powered on, the tape is read in by issuing the command:

ON

(Note: If the ON command is punched on the tape, it should be followed by a spare character such as a "rubout".

A command tape prepared by the government representative will be entered and the Project Officer will verify that the commands are executed.

Section 2.0 - Testing the Modifications to the Display Package

2.0.1 Set up and check the display ground motion scale factors for array and subarray Beam-type channels

With NORSAR short period data, for example, individual seismometer channels, subarray beams, and array beams require different scale factors (nanometers per bit). The following scale factors will be entered at the interactive terminal:

NAØ:HS .01	LAØ:LS .002
NAØ:LS .01	LAØ:LI .03
NAØ:HI .1	LAØ:HS .0105
NAØ:LI .1	LAØ:HI .01
NAØ:HB .3222	LAØ:HB .02
NAØ:LB .001	LAØ:LB .01

These values may be checked by using the PRINT command and a HEX dump.

2.0.2 Check the improved vertical scales on the display

Using the DISPLAY command, display any channel on six different axes employing a larger gain for each successive trace. It will be seen that the scales displayed alongside the vertical axis will automatically range from 10, 50, 100, 500, 1000, or 5000nm, permitting the vertical axis to remain at a fairly legible two centimeter length (approx.).

2.0.3 Verify that all traces extend to the end of the duration scale

Display any combination of channels from any of the seismic input stations, e.g., LAØ, ALP, NAØ. At the end of the duration of the screen it will be seen that all traces terminate before the next screen is displayed.

Section 2.P - Testing the capability to load the CCP with a TENEX binary file via the ARPANET.

First halt the CCP machine (making sure the BUS RESET SWITCHES are up) by loading in TAPE Ø (PSTOP) via the paper tape reader. Next load in the bootstrap tape titled LOADER. When the tape has stopped press RUN on the control panel. Bit 15 in the data word lights on the control panel will now be blinking.

Using a terminal linked via the ARPANET to ISI-TENEXA under user CCP, run the program RAWFTP-B.SAV; <CR>. The program will then ask for an "OCTAL HOST #" to which the response will be 47 <CR> (the current ARPANET Host Address for the CCP). The program will then ask for a binary filename. To load the CCP operating system, first TAPE 1 (DDT) must be loaded. Hence, give as a response DDT-26.BIN; <CR>. As the program is being loaded a count of ARPANET messages sent is shown both in the low order bits of the data word in the control panel and on the ARPANET terminal. When TAPE 1 has been automatically loaded the program will return control to TENEX.

To load the remainder of the CCP operating system, TAPE 2 (CCP) must now be loaded. Press RESET, LOAD on the control panel to restart the bootstrap. Then using TENEX run RAWFTP-B.SAV; again, this time giving as the binary file CCP2-5.BIN;. Once TAPE 2 has been automatically loaded it will self start.

Run the system in normal operational mode for *25 hours* to demonstrate proper performance when loaded by this procedure.

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Abstract

The Communication and Control Processor became operational in February of 1976. From February to June BBN provided technical support for the system in the form of 1) training course for the operating personnel, 2) maintenance and diagnostic assistance for the operation personnel, and 3) software refinements designed to make the system operation more reliable and convenient.